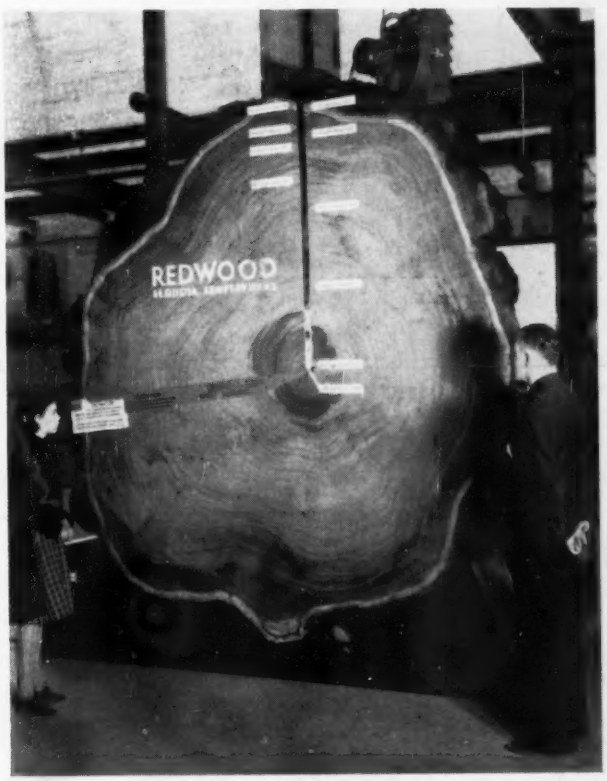
The Science Teacher

Volume V APRIL, 1938 Number 2



IN THIS ISSUE---

Vitalized Physics
Forests of Illinois
Reorganization of Physical Science Courses
Vitamin Studies
Photography by Infra-Red Radiation
Chemistry and Control of Nostrums
Guiding Principles in Physical Science
Soldering as a Science Project

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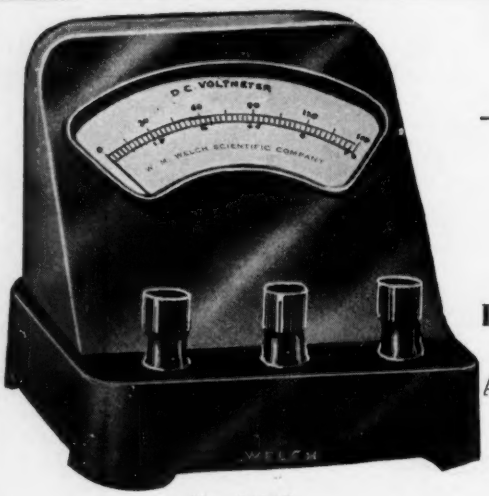

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The following projects are taken from teachers' work sheets and are published in mimeograph form in groups of five.

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By John Ayres, Community High School, Normal, Illinois

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By the following authors—
M. E. WOODWORTH, Pittsfield High School, Pittsfield, Illinois
S. A. McEVOY, Rockford High School, Rockford, Illinois
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JOHN C. CHIDDIX, Community High School, Normal, Illinois

Group 3

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THE SCIENCE TEACHER
201 North School Street, Normal, Illinois.

The Science Teacher

VOLUME V APRIL, 1938 NUMBER 2

Vitalized Physics

ALFRED M. CLEM

Morton High School and Junior College Cicero, Illinois

We who are teaching physics are apt to feel that ours is a practical subject touching intimately the lives of those we teach. Such should most assurdedly be the case, but is it? Teachers in other fields have envied the science teacher in this respect. If only they could bring their subjects home to their pupils! If pupils could be shown a need for studying their course! Our laboratory approach has been envied by others denied the privilege of making a subject less "bookish". Have we made the most of our opportunity to vitalize the sciences, particularly physics?

Our laboratory work, in particular, has been accused of being formal—"little more than busy work done in a perfunctory manner"—some one has accused. The pupils follow the manual, manage to get the results that are wanted, and write them up mechanically in a formal manner. To supply a missing word or two in an easily completed statement (probably to be found on page 42 in the text) is all the conclusion that is required. No incentive is given for doing the experiment than that so many must be finished before the next step is taken. Worse still the pupil is asked to follow step by step a procedure either found complete in his manual or dictated by the teacher. Drill is essential in classwork in certain places but is the laboratory the place for that activity?

Henry C. Morrison says, "If carrying out the directions of a manual—and filling in blank spaces in a prepared notebook is what is required of the laboratory—then neither teaching nor any other aspect of the instructional process is called for—nor will any learning result, save by chance. If, on the other hand, the objective is in the insights which the science is capable of generating, then teaching and a great deal of it is required".

We have faced the problem at J. Sterling Morton Hhigh school of trying to use our laboratory time as an opportunity for real problem solving. It is no easy matter to motivate every task set up for the pupil to cause him to see that here is a significant problem to be solved, here is a means of collecting facts bearing on the problem, and here are certain procedures to follow to get valid results and from which to be able to draw justifiable conclusions.

It is with these problems in mind that the following laboratory experiments which we have used are described. To be sure, the laboratory work is only one phase of our instruction which should be scrutinized in our endeavor to divest our teaching of those things which are preventing us from facing lifeward with our pupils. However, it is all that is attempted in this discussion.

One of our best experiments we call "Using Hooke's Law". After studying the relationship between stresses and their effects on elastic bodies, the class is asked to devise a use of the principle that strains are directly proportional to applied stresses. Suggestions regarding the construction of scales are given by members of the class as they have probably read in the text that spring scales

are constructed according to Hooke's law. The question arises of how can such a scale be made. It is finally developed that any elastic body such as a meter stick, door spring, rubber tube, etc., can be calibrated so that the average distortion per gram may be determined. Thereafter, any weight whose distorting effect is known can be found either by proportion or by reference to graph of the stresses and strains produced in the body. The accompanying writeup shows how successful the student has been in making a real weighing device.

"Buoyancy of gases" is likely to be so many words but can be made quite vital. Qualitatively, blowing soap bubbles filled with city gas illustrates the topic and makes it possible to discuss intelligently the real cause of a balloon or dirigible's "rise". Better still, attacking the problem quantitatively, we have an experiment where a meteorology balloon about two feet in diameter is filled with hydrogen gas and attached to a weight basket. The balloon is weighed before inflating it and the total load calculated as it just rises from the demonstration table. The weight of the air displaced is shown to nearly balance the gravitational or "down" forces. Hence, the cause of the rise is made apparent especially if the student is shown this is merely Archimedes' principle applied to fluids in general.

We find that the power units are made more clear by having the pupils find their own rates of working. A stairway is selected where the traffic is not too heavy during classes and the vertical distance is measured. In groups of three or four, the members of the class time each other in walking, running and running carrying a load up the stairs. After making the necessary calculations they see the effect on horsepower of changing the time of working or the force used.

When the metric units are discussed early in the the year pupils feel they are entering a strange world. One way to show them that centimeters, grams, cubic centimeters, liters, etc., are used today, not only in our laboratories but by industry as well, is to have them collect evidence of how these units are appearing on things we buy. This collection of labels, each bearing some metric unit is what one will be able to find if the project is carried out by the class.

At Morton we are trying to see if we cannot do more with our physics laboratory work than verify or develop principles. The pendulum, as an example, is studied not to develop or verify the pendulum laws but as an example or pattern of how a scientist proceeds to solve a problem. The expreiment is usually introduced by having the class observe a variety of pendulums vibrating. Why do they not all vibrate alike? is asked—a problem is recognized. This question brings forth a number of possible causes (hypotheses) whose merits are discussed but the class is warned that in science we do not attempt to solve problems by argument but rather "look in the horse's mouth to find the number of teeth" as Galileo suggested when asked to discuss that question. This leads to experimental investigation of each possible cause. The class is cautioned about having more than one variable under observation and the errors in thinking such carelessness may and do cause. Justifiable conclusions based on the observed data follow. The accompanying writeup shows what one pupil's reactions were. We find it a very profitable experience. We need more experiments designed like it.

Perhaps we could further vitalize our teaching if pupils could be encouraged to do more home experiments. Simple qualitative work is always possible but on exhibit you will find a more ambitious undertaking. The boy sought to weigh his father's coal truck applying what he had learned about gas pressure. His method of estimating the area of each tire supporting the load is especially interesting. His results are surprisingly in agreement with the known weight of the truck. Is there any one who would question that his knowledge of the pressure of gas was not more meaningful after this home laboratory experience?

(Continued on page 17)

Forests of Illinois

H. N. WHEELER

U. S. Forest Service Washington, D. C.

As in other states, the original forest area of Illinois of 6,528,000 acres has been reduced to about 3,000,000 acres, whereas, a fair estimate shows that 9,000,000 acres of the 35,867,520 acres of land in the State should grow trees. Furthermore, they should be grown because it pays. In 1936, a farmer in Indiana sold one black walnut tree for $600. It was probably worth much more than that. Several years ago a Missouri farmer sold a number of black walnut trees averaging 13 inches in diameter at $21.75 per tree. Another farmer harvested the Osage trees along side of his farm and netted $10 an acre a year from the time the little trees were planted until harvested.

For land that is rocky or of tight clay and will not grow commercial timber, there are values other than the production of lumber. The watershed worth of forest and brush cover is inestimable. Were the 2 1-2 million acres of rough land in the southern part of the state denuded of its cover the soil would soon wash away, the area would become a desert and the soil washed into the streams and reservoirs would do untold damage.

Farm lands with slopes of more than 3 per cent should be terraced or contour plowed or strip farmed. Very steep hills should not be cultivated at all, or if farmed, should be terraced in stair step fashion All interests will be better served if the rough, steep lands are kept in timber and neither grazed nor burned. Such land makes very poor pasture and is worth more to the farmer if permitted to grow trees. It is of the greatest value to the State and Nation if covered with trees, brush or heavy sod. The Central States Experiment Station finds that a hardwood forest unburned and not grazed will take in water from rains and snows fifty times more readily than the open field. Hundreds of thousands of acres in the Central States once covered with fine hardwood forests have been cleared and plowed, but are now so gullied and washed as to be useless for farming and of questionable value for wood production. Some of these lands can be brought back to timber production and many more acres must grow trees and brush to prevent the silting of streams and reservoirs.

The big flood of the Ohio River in 1936 was 10 per cent greater than it would have been had the timbered lands been properly handled. The Lake in soutwest Wisconsin that grazed timberland lost 9 per cent of the rain that fell during a certain period, and 1600 pounds of soil, while ungrazed woods adjoining lost 15 per cent of 1 per cent of rain and 17 pounds of soil in the same period. The Southern Experiment Station found during the flood of 1931 and 1932 on the Yazoo River in Mississippi where 27 inches of rain fell, that 62 per cent of the water that fell ran off the surface from cotton fields, but only 1-5 of 1 per cent of the rain ran from the wooded areas. Dams and levees are essential in flood control, but the forest is necessary on steep slopes to prevent the water from getting into the streams.

Some one has thought of a very vicious slogan, "Clean Agriculture," which means destroy all hedges, trees, shrubs and weeds along the roadsides so as to secure a few extra feet of land for cultivation. Too much land is already being cultivated and the roadside trees and brush have a greater value to the farm than the few additional farmed acres would yield. Roadside trees and shrubbery as well as the woodland areas have other values that far outweigh their worth for wood and lumber. They furnish shelter for birds and wild animals that destroy harmful insects and weed seeds. Some birds eat their weight in insects everyday. We spray for this bug and that moth. If there were birds so

(Continued on page 15)

THE SCIENCE TEACHER

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The Illinois Biology Teachers' Association
The Indiana High School Chemistry Teachers' Association
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ASSOCIATION MEETINGS

Indiana chemistry teachers are looking ahead to a State meeting at Indiana State Teachers college at Terre Haute under the leadership of Edward Zetterburg, president of the Indiana High School Teachers Association. He is assisted in local arrangements by Professor P. D. Wilkinson of Terre Haute. The program as arranged offers many choice features both in topics presented and field trips. Details of the program may be found on page 12.

Illinois chemistry teachers have just enjoyed another splendid get-to-gether and program at the University of Illinois. The papers there presented will appear in later issues of The Science Teacher. Professor George C. Ashman of Bradley Polytechnic Institute is to be complimented on his splendid work as president of the association for the past two years.

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Problematic Situations

EDITORIAL COMMENT

The Hour Period

The problem of the sixty minute period for science classes is increasingly coming to the attention of science teachers. It arises from the fact that many students may have supervised study for part of the period. The result in the science classes is that usually they have their laboratory time reduced from two double periods, each 45 minutes in length per week, to two single hour periods. Laboratory time is thus reduced one-third. If the three laboratory periods are run one week and two the next, the hour period is still too short to do an experiment that requires much time. Especially does it limit the time available for thinking out problems arising out of the experiment and for understanding what is happening and why. After all, thinking and understanding are the most important activities related to laboratory work

It appears to be very timely then that the Illinois Association of Chemistry Teachers is taking up this problem of the hour period, and collecting some data about it with the purpose of arriving at some conclusions. Mr. S. A. Chester of Bloomington High school, Secretary of the Association has sent out a questionnaire to over 100 representative schools in Illinois and other States and nowhas a very splendid return which he has ably interpreted for the Association at the Urbana meeting. The facts and conclusions will be presented in the October issue of The Science Teacher.

Two-Year Physical Science Course

Another problem now pushing to the foreground is that of reorganizing physical science courses. Should physics and chemistry be merged and reorganized into a two-year physical science course giving due regard for the overlapping features of the two courses and building the course around functional objectives, or should chemistry and physics be kept as separate one-year courses and reorganized so as to make them serve the needs of the high school student.

The first plan has to its credit the possibility of getting away from the traditional college type course yet much in evidence, eliminating much dead timber and revitalizing the physical science so that it will mean enough to the average high school student to cause him to want it. However, should it prove to be merely a rearrangement of the present courses under just a different name, then there is little excuse for the change, especially since it might inconvenience and cause loss of credit by students in transfering from one school to another which had a different organization of the physical science courses. A two year physical science course is being introduced on an experimental basis into the University High school of the University of Chicago. This work as well as that of other schools should be followed closely for developments.

The benefits derived from organizing physical science on a two year basis can likely be attained by drastic revision of physics and chemistry as such so as to meet present needs. Now that the high school contains a fair cross section of our youth rather than a select group as formerly the courses should be planned accordingly. What is needed is science on a functional basis for life rather than science only as a preparation for college. Likely less than five per cent of those taking physics or chemistry in high school will elect these subjects as their major in college.

On the other hand some teachers will point out that the principles of physics and chemistry that are to be taught are the same whether in the preparation for college or for life. This is quite true. However there is a vast difference as to how they are presented and as to what objectives are attained.

—John C. Childdix

Reorganization of Physical Science Course

Committee Report

RUSSEL S. HOWARD, Chairman

Lyons Township High School La Grange, Illinois

The listeners or the readers of a committee report are entitled to know something of the conditions under which the report was compiled and something of the background of the committee members. Unless the solution of the problems indicated are solved by objective data the recommendations made are but opinions, often based to be sure upon some experiences. The recommendations herein made may be considered a mixture of objective and subjective opinions colored by the training and working environment of the committee members. Only a portion of the recommendations were unanimous, they represent, however, majority opinions. All members of the committee were not present at each of the meetings and, of those present, all did not remain for the full length of the sessions.

The schools represented by the members of the committee draw their students from the laboring classes in Chicago, from semi-industrial surburban communities, from industrial surburban communities, and from strictly residential surburban and rural communities. This represents a cross section of a metropolitan territory taken from the hub to the rim.

The teaching experience of the committee members is not confined to the subject or the subjects now being taught. Most of them have taught at some time each of the physical sciences, general science and one or more of the biological sciences. Three now teach chemistry, one teaches general science, one physics and two chemistry and physics.

The urge to do something to the school curriculum has been present for many years. In 1892 a committee of ten was appointed by the N. E. A. to make a study of curriculum reform. Another was appointed in 1899 and a number of others since that time. The concerted efforts of these past committees have greatly affected the course of education in this country. For example, training of teachers has improved, school equipment has been enlarged and laboratory work introduced into all of the sciences.

There were some unfavorable early effects produced as well. The science sylabi were considered too authoritative, subject matter became the chief emphasis rather than the principles of science and too much material was introduced in order to meet the requirements of the sylabi. The idea became firmly established that the training of all should be the same, regardless of the destination of the individual.

It is interesting and of value to recall the stated purposes of these older reformed and the recommendations they made. Many of the same problems that confront us today were present years ago. We may expect many of them to be present in the years to come. There are, however, new problems presented today because of the changing environments and new economic adjustments.

In the committee reports of this earlier period we find much stress laid upon the ways in which the youngsters could be coaxed to remain during the four years of high school. In 1910 approximately 71per cent of the students entering high school failed to graduate, and in 1920, 63 per cent never finished the fourth year. The recommendations made to meet this condition called for the creation of new courses and the reorganization of those already existing. Today the problem is reversed, it is a problem now to adequately provide for the great number of youngsters that do remain for the four year high school period. Again we seek a solution by increasing and changing our present courses of study. If it is true that the types of youngsters who formerly would have entered industry before the completion of the high

school years are those who are now in need of a radical change in our school set-up, then we must admit that this is the pare of our high school population upon whom much of our effort of reorganization is and has been centered.

The committee has made some study of the science curriculum trends in their own territory. The results of this study are shown in the following tabulations:

Total

Combined Enrollments in the Seven High Schools Represented by this Committee

Year	1935-'36	1936-'37	1937-'38
Total Enrollment	22,847	22,969	22,225
Chemistry	1,917	2,062	2,068
Physics	2,270	2,392	2,419
General Science	5,060	5,227	4,399
Physical Science		16	86

Percentage Change in Enrollment Based On 1935-1936

Year	1935-'36	1936-'37	1937-'38
Enrollment		+0.53	-2.72

Per Cent of Total Enrollment Registered In Sciences

Year	1935-'36	1936-'37	1937-'38
Chemistry	8.40	8.98	9.30
Physics	9.93	10.42	10.89
General Science	22.14	22.76	19.89
Physical Science	0	0.07	0.39
Total	40.47	42.23	40.47

It is interesting to note that in our own territory, at least, the high population has decreased during the last three years, but the enrollment in the regular chemistry and physics courses have increased slightly. General science has decreased somewhat, due to the shifting of general science from the high school back to the grades in some of our schools. In our own high schools we are not confronted with the problem of maintaining the enrollments in our regular chemistry and physics courses by offering something that would be more attractive. Any changes looking toward the lowering of our present standards might, however, bring a greater number of high school youngsters into contact with some sort of science training. If this is an aim, then the question arises whether it is better to maintain what we science teachers would call a high standard in our regular physics and chemistry courses and add other courses designed to satisfy those who are unable to do the work required in what we might call standard requirements.

This leads us to two of the topics considered by this committee, namely, "Should a combination physical science course be introduced into the high school to care for those who are unable to carry successfully the regular courses in these subjects as now given? Should a modified chemistry and a modified physics course be designed to care for this same class of youngsters?"

The majority of the committee believe that there is a need for some modified science curricula to meet the needs of those students who are unable to carry successfully the regular physical science courses as now laid down in our own high schools. These are to supplement not to displace the differentiated special science courses.

These courses should not be lacking in the stress laid upon basic scientific principles. This would tend to off-set the danger of too much generalization. The generalizations that are made should follow the study of basic principles that are attempted. This course should be made as extensive as possible, keeping in mind the supposed limitations of those who are registered in this type of course. It should be recognized that there is much descriptive scientific material that does not need to be taught. Attention can be called to it but its content is so simple as to be self-evident or it may be obtained as well from reading as from the harangue of the teacher. Including too much of this sort of material will not increase the respect of the pupil for science nor will it satisfy the natural desire for knowing the why-for of

(Continued on page 14)

Vitamin Studies

A Science Project

JOHN AYRES

Normal Community High School — Normal, Illinois

Within the last few years the word vitamin has become an everyday byword in advertising. However commonplace these disease preventing substances seem in print, they are little understood. If the average person were asked the value of vitamin A, the answer would be, in nine cases out of ten, "Isn't that the vitamin that keeps babies from being bow-legged?" From this confused answer the teacher can readily see that the kind of information found on bill boards or on milk bottle caps is too abstract and is considered merely as a selling point, not as an essential food constituent of great importance to health.

The author has found the albino rat* a very excellent animal for use in experimental study. This animal is clean, fairly prolific, easily maintained, and docile. Also the albino rat lives about thirty times as fast as a human, making possible results within a few weeks time. Boys, and girls as well, in almost every town throughout the United States keep white rats as pets. A pair can be procured for a small sum. The female may be bred at about two and one-half months. Three weeks later she will give birth to a litter, usually eight to twelve, and will soon mate again unless separated from the male. The young should remain with the mother for at least three weeks.

For the following tests, at least one male and one female should comprise each group. The stock diet should consist of whole wheat ground, 650 grams; whole milk powder, 250 grams; meat and bone scrap, 100 grams; and salt, 13 grams.

Vitamin A is formed in the animal body from the pigment carotene, is easily destroyed by prolonged heating and oxidation, and is fat soluble.

The female having the young should be placed on the stock diet, but it should be modified by replacing skim milk powder for whole milk powder to reduce the amount of Vitamin A stored by the young rats. When twenty-one days of age the test animals should be separated into two groups, weighed, and one of the two placed on the following vitamin A free diet.

Casein (extracted with hot 95 per cent alcohol) 18 grams; corn starch, 57 grams; dried yeast (one-half of this irradiated) 10 grams; Osborne and Mendel salt mixture, 4 grams; salt, 1 gram; Crisco, 10 grams.

The animals should be kept on this diet until the animals show signs of avitaminosis, i. e., lose weight and become sensitive to light, the eyes showing irritation. The remaining group should be given a diet similar to that of the first, excepting that butter is used instead of Crisco or lard. At the end of the experiment when the desired results have been obtained change the diets of the animals and again graph the weight records.

In testing the potency of material believed to contain vitamin A several of the rats on the vitamin A deficient diet are fed the test material while an equal number are given a quantity of a vitamin A standard for which the potency has already been determined, a unit of vitamin A being that amount of material which when fed daily induces a gain of three grams per week.

Vitamin B is water soluble and is destroyed by moist heat, especially in an alkaline medium. The following diets are satisfactory to show the effect of this vitamin.

Vitamin B Free Diet	Group 1	Group 2
Cod-liver oil	2	2
Casein extracted with 60 per cent alcohol	18	18
Corn starch	58	58
Butterfat (vitamin B is lost in liquid)	8	8
Osborne and Mendel salt	4	4

(Continued on page 23)

Photography by Infra-Red Radiation

HERBERT JOHNSON

Eastman Kodak Company Rochester, New York

Among the interesting uses of ultra-violet photography are the examination of questioned, altered and faded documents, restorations in works of art, and other such subjects which cannot be examined with success by the ordinary methods of photography.

There are two distinctly different methods of using ultra-violet radiation for taking photographs. The first of these is strictly analogous to ordinary photographic methods whereby the photograph is made by the light which is reflected from the object. In the case of ultra-violet photography, however, both the light falling on the object and that reflected from it is invisible. The stand in a dark room in which there is a source of ultra-violet radiation, even though it cannot be seen, certain parts of our body, such as the skin, teeth and finger nails, glow with a soft light, and show up very clearly. This is due to the effect known as "fluorescence".

Many objects, when irradiated with ultra-violet light, give off a new light which is longer in wave-length than the ultra-violet. While the ultra-violet is completely invisible, this fluoresced light, being of longer wave-length, is visible, and is usually blue or greenish-yellow. In addition to this faint visible light, there is also reflected ultra-violet, which cannot be seen, but is much stronger photographically than the other.

In the first case, the object is illuminated with ultra-violet light and visible light is excluded. Only the ultra-violet light acts upon the photographic plate. In the second case, the object is again illuminated with ultra-violet radiation, but only the fluoresced light coming from the object is allowed to act upon the photographic plate. This is done by placing a filter over the lens which absorbs all the ultra-violet but allows the visible light to pass through.

The possibility of deciphering altered documents and examining paintings, etc., by the ultra-violet, depends upon the relative reflecting powers of the papers and inks in the case of documents or of the various pigments in the case of paintings, or else on the different extents to which these materials fluoresce.

For example, paper is composed mainly of cellulose, a material which fluoresces strongly in the ultra-violet. If paper is written on with ink and the ink is subsequently erased or bleached, it usually happens that the parts of the paper where the ink was, have a lower fluorescing power than the rest of the paper. In this way a photograph taken by fluorescent light may show up the original writing even though it is quite invisible to the eye and cannot be photographed by the usual photographic methods.

It is doubtful whether ultra-violet photography is of much interest for taking photographs in the dark in the way that infra-red sensitive materials have been used. Many materials fluoresce quite strongly in the ultra-violet, particularly such objects as the skin, teeth, and fingernails, and therefore if these subjects were "illuminated" as it were with invisible ultra-violet rays, they would be quite visible by virtue of the fluorescence induced by the ultra-violet.

There is no general rule determining the choice between the two methods of ultra-violet photography. If the detail to be shown can be seen by fluorescent light, it can be photographed by fluorescent light. If the detail does not appear thus, it may or may not be possible to photograph it by reflected ultra-violet, and only experiment will tell. The method using reflected ultra-violet is quicker and if convenient should be tried first.

In photographing objects by reflected ultra-violet, a suitable source of ultra-violet radiation must be used and a filter which transmits only the ultra-vio-

(Continued on page 20)

Chemistry and Control of Nostrums

J. W. NECKERS

Southern Illinois State Teachers College Carbondale, Illinois

Statistics show that there are as many students in college today as there were in high school a generation ago. They likewise show about a seventy per cent increase in reading by the public in the last twenty-five years. With the decline in the reading of books, there is probably three or four hundred per cent increase in the circulation of magazines and newspapers. Also, the rise in the educational level and our mechanical age have caused scientific terms to be much more common. Both of these advances establish an ideal condition for the propagation of information through advertising media.

The challenge is apparent: Which shall be the source of scientific education of the public, the magazines and their advertisements or the material presented in science classes?

A suggestion follows that a unit of work be organized for the chemistry course in which the student will investigate many of the products on the market to determine the validity of their claims. This will serve to give the course practicality, interest and even monetary value. Examples of exhorbitant prices will be found in eye washes, gargles, astringents, face powders and creams and many other cosmetic products. Examples of pseudo-scientific claims that will not withstand scientific investigation will be apparent from a study of vitamin face creams and soaps, gargles, etc. Vastly exaggerated claims will be found in advertisements when compared with data from the American Medical Association and other sources of reliable information regarding gargles, cold remedies, face creams, tooth pastes, etc. Actual cases of dangerous nostrums will be found to be popular because of misinformation or deliberate lack of information, as in crystal quackery, gargles, tonics, etc. (To illustrate these various possibilities, advertisements from current magazines were used, in some cases to refute their own claims.)

An obvious result of such projective investigation will be the realization of the need for a controlling agency. The American Medical Society is doing excellent work in revealing the actual contents and the value of many products, but its tests are not publicized sufficiently. The best cure is prevention The present Pure Food and Drug Act was passed in 1906—a true example of "horse and buggy age" legislation. It should be revised to demand control of advertising, wider powers of prosecution and standardization of labeling in foods as well as drugs.

Finally, chemistry teachers should debunk modern advertising in magazines and radio programs. Students should be taught to distinguish between real and pseudo-scientific claims, taking the "I'm from Missouri" (scientific) attitude toward what they read and hear. Teachers also should make available the reading material furnished by the several debunking agencies, books of pertinent character, and phamphlets published by the American Medical Association. They should anoint themselves apostles for the prevention of the prostitution of science.

TO DEMONSTRATE BREAD MOLD

Tiny pieces of bread in deep cell slides moistened and innoculated with mold spores will produce a growth within a few days that can be observed with a low power microscope.

A cover glass may be fastened over the opening with vaseline. The entire slide should be kept in a moist chamber while the mold is growing. When a desired stage is reached the slide may be placed in a warm dry place and dried enough to prevent further growth without removing the cover glass. Demonstrations prepared in this way will keep for a number of weeks.

Guiding Principles in Physical Sciences*

NELLIE BATES

Champaign High School Champaign, Illinois

I. Physical Science should be taught so that it will contribute to the physical and material well being of students taking it.
   A. Physical
      1. Health
         a. Ventilation and humidity
         b. Proper illumination and care of the eyes
         c. Food chemistry
      2. Discipline—the teacher should provide situations where the student may learn to do, and enjoy doing difficult tasks.
         a. Keep apparatus in order
         b. Write careful, neat reports
         c. Perseverance in a task until it is properly finished
   B. Material
      1. Definite service to home and daily life
         a. Enough information on common home appliances should be given so that the student can make repairs on them when necessary
         b. The importance of creating public opinion and legislalation on the control and testing of advertised products and the necessity for defense against nostrums and quackery should be stressed.
         c. The course should be taught so that the students will start thinking on the merits of things bought and sold, such as kinds of heating plants, refrigerators, fuels, kinds of baking powder, etc.
      2. Understanding of both common and new appliances used in daily life should be gained.
      3. The many vocational possibilities that might be suggested by a study of science should be brought out in the course.

II. A knowledge of Physical Science should assist in social appreciations and adjustments.
   A. Science should be taught so that the student can see the posibility of making leisure both enjoyable and profitable.
      1. Hobbies can be developed, such as:
         a. chemical laboratories
         b. radio construction
         c. automobile repairing
         d. photography
         (Hobbies often become a source of income or grow into a vocation.)
   B. Science may be taught so as to make the student conscious of scientific discoveries.
      1. Knowledge and use of the laws of electricity have made history the last 100 years
      2. The development of the automobile and airplane was delayed until the chemist found a suitable fuel.
   C. The student should be made to realize the economic significance of the use of scientific discoveries.
      1. The discovery of tungsten makes it possible for us all to have light bulbs in our homes.
      2. The electrolysis of aluminum from the ore makes it an economical and abundant material for many uses.
      3. The development of reapers and binders make food more abundant and cheap.
   D. The course should give the scientific knowledge necessary so that the student in adult life can use intelligence in voting or directing such civic enterprises as:

(Continued on page 22)

—PROGRAM—

Indiana High School Chemistry Teachers' Association

April 15 - 16, 1938 **Terre Haute, Indiana**

Friday Morning: Visitation of Rose Polytechnic Institute, Garfield, Wiley Gerstmeyer, and Laboratory High Schools in Terre Haute.

Friday Afternoon: Program.

Place: Science Hall, Indiana State Teachers College.

Chairman: Edward Zetterberg, President of the Association, Muncie, Indiana.

Need for a Better Balanced Curriculum as Affecting High School Science Courses, Kenneth E. Conn, Bloomington, Indiana.

Experiment to Show Metals Replace Hydrogen Proportional to their Valences, Frank B. Wade, Indianapolis.

Practical Science as a Substitute for Chemistry, June E. Osenberg, Martinsville, Indiana.

Results of Mathematical Tests in Chemistry, Walter C. Geisler, Indianapolis.

Polaroid Equipment, Leslie I. Steinbach, Chicago Appartus Company,

Friday Evening: Place: Parson's Hall, Indiana State Teachers College.

Dinner in honor of Professor Edwin M. Bruce, retired professor of chemistry at Indiana State Teachers College. Probably an address by Dr. Lyons of Indiana University.

Several Erpi Classroom Instructional Sound Films on such topics as Molecular Theory of Matter, Colloids, Catalysis, Fundamentals Acoustics, etc., M. L. Steeppelwerth of the Melmoy Picture Service, Ft. Wayne, Indiana.

Saturday Morning. Place: Science Hall.

Chairman: Edward Zetterberg, Muncie, Indiana.

Dry Ice as a Source of Carbon Dioxide in the Solvay Experiment, Allan R. Stacy, Indianapolis.

The Origin of a Science Mural, Robert L. Black, Indianapolis.

Basic Training and Requirements of a Technical Education, Professor Ralph K. Strong, Rose Polytechnic Institute, Terre Haute

Chemistry and Biology as the Foundation of a Medical Education in Indiana, James H. Brayton, Indianapolis.

A Project in Fractional Distillation, Richard Martz and Charles Good, Students of Lois Martin, Indianapolis.

Useful Chemical Charts, Druley Parker, Indianapolis.

Saturday afternoon: Trip through the plant of Commercial Solvents Corporation.

Exhibits. It is planned to hold an exhibit of work of pupils and teachers. This includes hobbies and it is hoped that every high school teacher attending will contribute something.

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---

4 New Science Guides

New Physics Guide and Laboratory Exercises by Henderson
Chemistry Guide and Laboratory Exercises by McGill and Bradbury.
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A Learning Guide in General Science by Boyer, Clark, Gordon, and Shilling

Each of these books is an integrated laboratory manual, study guide, review program, and complete objective testing program under separate cover—all in one—for the price of the average laboratory manual. Each is for use with any standard text in its field.

These new science guides allow the teacher who desires it to use a library method of study, or a contract method of study, or the Morrison unit plan, or the plan of working experiments before classroom study is started.

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A NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

The Union of American Biological Societies through its committee on the teaching of biological science is assisting in the organization of a national association of teachers of biology in secondary schools. Certain tendencies have been noted that would indicate that the teaching of biology over the United States is in need of some assistance if it is to hold its own with the other ever increasing subjects in the high school curriculum.

Mr. Oscar Riddle, chairman of the committee contacted the Illinois Biology Teachers Association last fall and the general aspects of the plan were discussed in the 1937 meeting of that Association. With a view to further investigating the proposed plan a committee was appointed consisting of Miss Katherine Allen, Decatur; Mr. Roy E. Davis, Aurora and Mr. P. K. Houdek (ch), Robinson.

The chairman of this committee met with the committee from the Union of American Biological Societies during the meeting of the A. A. A. S. in Indianapolis. It is the purpose of the organizing committee to do all that they can to assist the organization to get started and later to act in an advisory capacity. The active running of the association is to be left to the members of the group who will be teachers of biology in secondary schools.

The committee of the Illinois Biology Teachers Association is doing its work by correspondence in order to arrive at a decision within the next few weeks. A number of members of the Association indicated last fall that they were interested in such an organization. On the basis of these indications and the action of the committee the officers of the Association will be asked to recommend the National Association to our members.

The plans of the organizing committee call for the first or organization meeting at the time and place of the summer meeting of the National Education Association.

PHYSICAL SCIENCE COURSE

(Continued from page 7)

things that exists, to some extent, even among the duller students. No course which is taught without stressing the fundamental scientific concepts should be named chemistry or physics, nor should a course that does not make use of the tools of the subject as mathematics in physics or the use of formulas and equations in chemistry carry the name of those subjects.

We wish to point out the inherit dangers that are introduced through the inclusion of modified science courses in the high school. Unless the administration makes a definite effort to place only those students in these courses that belong there because of their inability to carry the regular physics and chemistry courses, these courses will become the dumping ground for the mentally competent but lazy individuals. It has come to the attention of the committee that this condition has already become serious in some of the high schools that have adopted modified science training. We do not recommend that colleges recognize these modified courses for those who enter science majors.

Our remaining topic for consideration is: "Should general science be retained in the high school curriculum or should its equivalent be taught in the grades, beginning in the early years and carried through as a progressive course from year to year"!

The majority of the committee agree that the ideal place for general science is in the elementary school. General science, as referred to here, means at least the subject matter as now included in the first year of the high school. With the proper orientation it is very likely that the scope of this subject could be increased above that now given in the freshman year in high school by extending its period throughout the elementary grades. The chief advantage of placing general science in the elementary schools lies in the fact that the pupils are brought into contact with the subject over a longer period of time. The approach could be, therefore, more gradual, as-

(Continued on page 16)

FORESTS OF ILLINOIS

(Continued from page 3)

much spraying would be unnecessary. The spray kills good insects the same as the injurious ones. Therefore, sometimes spraying is of doubtful value especially if it poisons honey bees and and kills good insects and birds.

Wildlife often has a real commercial value since a landowner may charge for hunting privileges on his lands. In some regions of the South landowners lease their areas to sportsmen for enough money to pay their taxes. But even though lands are not leased in this way they supply hunting and recreation for the family. Everyone needs outdoor recreation and the hunting of animals and birds furnishes the best kind of outdoor play. A person may not hunt on another man's land without consent of the owner, so again the public forest where public shooting is permitted is necessary if the town man or the person who owns no land can hunt. Game refuges are necessary where animals may breed and scatter to the outside public shooting grounds. Some private landowners have combined their holdings. Restricted hunting under a permit system is arranged to the advantage of all parties.

Camping is enjoyed by millions of people every year. This recreation can be found on private lands where charges are made for camping facilities. Again the need for public forests is apparent. Here campgrounds equipped with sanitary facilities, cooking places and play areas are maintained by the Government or State. In the National Forests swimming pools and ball grounds are prepared for the enjoyment of all. People are going to these places each year by the millions. Some stay but a short time to fish or hike or just rest, while others stay for the whole summer season and even longer. This is the day of sports and many are enjoying play in winter—skiing, snowshoeing, tobogganing and hiking. The forest has become a year round play place.

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REORGANIZATION OF PHYSICAL SCIENCE COURSE

(Continued on page 14)

similation more complete and the subject matter more extensive. It is understood that there are reasons why the transfer of general science to the elementary schools would cause difficulty at this time. First, there is a lack of adequately trained teachers in general science, secondly, the lack of uniformity in the science curricula among the several grade school districts furnishing students to one high school, thirdly, the lack of adequate funds for the purchase of equipment. There is a definite trend in our own territory toward a shifting of general science to the elementary school or making it elective in the high school. This accounts for the drop in enrollment in general science during the past few years.

Members of the Physical Science Sub-Committee

Mr. Russell S. Howard, Chairman, head of Science Department, Lyons Township High School, La Grange, Illinois.

Mr. A. G. Greene, Proviso Township High School, Maywood, Illinois.

Mr. I. E. Haebich, Asst. Principal, Riverside-Brookfield High School, Riverside, Illinois.

Mr. W. W. Kronsagen, Glenbard Township High School, Glen Ellyn, Illinois.

Mr. A. R. Moore, Head of Science Department, J. Sterling Morton High School, Cicero, Illinois.

Mr. R. A. Soliday, Oak Park-River Forest High School, Oak Park, Illinois.

Mr. Charles Randolph, Crane Technical High School, Chicago, Illinois.

ILLINOIS JUNIOR ACADEMY MEETS

Illinois high school science students should look forward to Friday, May 6, for the State meeting at Carbondale as guests of Southern Illinois State Teachers College.

THE ASSOCIATION OF CATHOLIC SCIENCE TEACHERS OF CHICAGO

A newly formed organization that gives promise of serving a distinct need is the Association of Catholic Science Teachers of Chicago. The first meeting was held on September 13, 1937 with thirty-two in attendance representing fifteen Chicago high schools and two Milwaukee, Wisconsin high schools.

Brother Charles, professor of Biology of Saint Mary's College of Winona, Minnesota, who is well known in the teaching and scientific circles of Illinois acted as temporary chairman and led the discussions. Plans were made for the adoption of a constitution and election of officers at the next meeting.

The purpose of the organization is plainly one of association, to exchange ideas, improve methods and to give and take ideas about laboratory apparatus, curriculum etc.

Three or four meetings are to be held each year with each meeting being held at a different high school in the Chicago area so all the teachers can become acquainted with the facilities in the different schools and so improve their own. The meetings are to be full day programs with general and sectional divisions.

Brother Charles and the members of this new organization are to be congratulated on this fine step for the improvement of their work.

VITALIZED PHYSICS

(Continued from page 2)

In conclusion, physics laboratory work may be made quite alive. Teachers may have to break away from typical procedure in performing the experiments. There are a vast number of us waiting for some one to write such a manual or in some way show us how to utilize our laboratory time to a better advantage. In the meantime, why not experiment a little ourselves in the same manner that we would have our pupils try to do?

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SOLDERING AS A SCIENCE PROJECT

Whether building a radio set, constructing a metal box, repairing a tinned roof or eaves trough, or joining metal pipes for the plumber, soldering is a great convenience if not a necessity. The chemical principles involved are easily understood and the skill of manipulation soon acquired It is a very practical high school science project.

Soldering equipment and materials consist of a copper soldering iron of sufficient size, a means of heating it, solder, and a suitable flux for cleaning the metal surfaces. The iron should be heavy enough to fuse solder when placed one-fourth inch from the iron on the heaviest work for which the iron is to be used. An electrically heated iron is the most convenient for shop and indoor work.

The type of flux will vary according to the metal being soldered. In general the acid type is most generally used. For the amateur the acid core wire solder containing a flux in the hollow center is usually all the flux needed. The compounds used as fluxes include rosin, borax, hydrochloric acid, zinc chloride, stannous chloride, and ammonium chloride. A very satisfactory flux consists of 15 to 20 per cent zinc chloride, 20 per cent glycerine, and 50 to 60 per cent water. Ammonium chloride may be added if desired. For galvanized products, hydrochloric acid should be used as the flux.

The purpose of the flux is to clean the metal surface and protect it from oxidation until solder can be united with it. The metal surface will be coated with a layer of oxide, carbonate, or other salt with the pure metal. The flux reacts with the metal coating to form an easily fusible compound. Stannous chloride has a reducing action in addition to forming an acid solvent. Scraping or otherwise polishing the surface before the flux is applied is advantageous.

Before a job of soldering is attempted, the soldering iron should be cleaned and tinned. If it is not in proper condition, it may be polished by using a file or emery paper or by rubbing it on a soft brick. A better method of removing scale is to heat the iron to a red heat and hammer it on all faces on an anvil. After being cleaned the iron is heated, treated with a flux and touched with with a drop of solder on each face. The solder should spread at once to form a thin film over the cleaned surface. Any flux will work. Rubbing the hot iron in solid ammonium chloride until the solder sticks is often a favorite method.

In soldering, the metal surfaces are first thoroughly cleaned, usually by scraping with a knife and polishing and then treated with a flux such as ammonium chloride or stannous chloride, if the solder is not of the acid core type. The iron is heated hot enough to fuse the solder on the metals being worked, but not red hot. For a small job the solder may be touched to the iron to form a droplet on the side or tip. The iron and solder are then applied to the metal until the solder sticks. For running a long joint between two metal sheets, the sheets should be first tinned where the joint is to be. This is accomplished by cleaning the metal as usual, applying a flux, and running along it the heated iron to which a coating of solder is adhering. More solder should be touched to the side of the iron as needed. When the two surfaces of the metal sheets are thus fully tinned they are placed together and fused by means of the hot iron. In soldering, the movement of the iron should be as rapid as possible so as to prevent the formation of a smeared joint.

PROJECTS SHOWN IN MOVIES

Project work may now be seen under actual working conditions in a new film "Chemistry Projects in the High School" prepared for distribution by The Science Teacher. (See page 24). Students are shown at regular project work in the laboratory and in addition several projects are traced through in some detail showing not only procedures but also the close relationship to sudent interests and to home and school life.

FREE COPY UPON REQUEST

SCIENCE DIGEST

Are you acquainted with this magazine? It presents news of scientific progress — taken from the scientific journals of the world — in clear, concise, easy-to-read torm. After you have seen a copy we believe you will agree with other teachers who are using it in their class-room work.

That is why we offer to send you a copy of a recent issue free upon request. There are special offers, too, for students that make Science Digest an inexpensive auxiliary to your text books.

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Here Is a Typical Six Months' Index

Articles that appeared in Science Digest during the first six months of 1937 were indexed as follows:

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Engineering	**Mammals**	**Mining**	**Natural History**
Agriculture	**Medicine**	**Fishes**	**Physics**
Anthropology	**Biology**	**Industry**	**Physiology**
Archaeology	**Botany**	**Insects**	**Psychology**
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PHOTOGRAPHY BY INFRA-RED

(Continued from page 9)

let and no visible light must be used over the light source or over the camera lens. The operations must take place in total darkness, if the filter is over the light source. If the filter is applied to the light source rather than the camera lens, the same lighting unit can be used for the fluorescence method as well.

A suitable source of ultra-violet is the mercury vapor arc lamp. These are available in many forms for a variety of purposes such as photographic studio lamps, industrial light sources, photographic copying and printing lamps, and scientific and medical purposes. They are available either as quartz lamps or as glass lamps.

If the mercury vapor lamp is of clear or quartz, it must be used in conjunction with an ultra-violet transmitting filter such as Corning Violet "Ultra" Glass, No. 586, 8-10 mm. thick. The lamp should be mounted in a light-tight ventilated metal box with the filter mounted at one side. The ultra-violet radiation supplied by this arrangement is the 365 millimicrons mercury line.

Lamps are available in which the glass of the tube itself is an ultra-violet transmitting filter, absorbing visible light. The Corning No. 586 filter need not be used with such a lamp.

In photographing objects according to the reflected ultra-violet method, the subject should be illuminated with a source such as that described above, and the photograph made in an ordinary camera. Even though the glass of an ordinary lens is not very transparent to ultra-violet radiation, the transmission is sufficient so that an exposure can be made in a comparatively short time.

All photographic plates and films are sensitive to the ultra-violet, although it is preferable to use a material which is non-color sensitive. A plate such as the Eastman 33 or Eastman Process will be satisfactory, or a film such as the East-

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man Commercial or Eastman Process. Exposures are about 1 minute at f|16 with the General Electric 220-volt horizontal Uviarc burner.

In photographing objects by Ultra-violet using the second, fluorescence, method mentioned above, the same arrangement is employed for irradiating the subject. In this case, however, it is necessary to use over the camera lens a filter which does not transmit any ultra-violet rays but which freely transmits all of the fluorescent light from the object. This is necessary, otherwise the picture would be taken by the reflected ultra-violet method, since this reflected ultra-violet is many hundred times stronger photographically than the dim fluorescent light.

A filter to be used over the camera lens for this work must have the following characteristics: It must be able to absorb all radiation below 400 millimicrons; it must not fluoresce when exposed to ultra-violet rays; it must be stable to light; and it must be stable with time. A filter specially made to have these characteristics is the "Wratten No. 2A." It is particularly suitable for fluorescence ultra-violet photography.

The plates most suitable for ultra-violet photography using the fluorescence method are Wratten Panchromatic Process plates. Using the Uviarc lamp mentioned, at 20 inches from the subject, a suitable exposure for obtaining photographs by fluorescent light is about 20 minutes at f|4.5.

The following publications will be of interest:

"Hanovia Research Apparatus." Hanovia Chemical and Manufacturing Company.

"Uviarc Lamps and the Ultra-Violet," General Electric Vapor Lamp Company.

"Fluorescence Analysis in Ultra-Violet Light," by J. A. Radley and J. Grant, London, 1933.

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GUIDING PRINCIPLES

(Continued from page 11)

1. street illumination
2. sanitary plants
3. water supply
4. gas and electric supplies

III. The study of physical sciences should be taught so as to develop desirable mental attributes and emotional attitudes.

A. Mental attributes

1. A knowledge and appreciation of the fundamental scientific principles should be stressed at all times.
2. To train the student to have the
   a. Ability to read, talk, and write intelligently on scientifiic subjects.
   b. Ability to work with and think with scientific tools.
3. The teacher may be able to discover and encourage an occasional scientific genius.

B. Emotional attitudes

1. The teacher should strive to engender an abiding intellectual curiosity.
2. The teacher should help the students to substitute scientific methods of thinking for common superstitions and fears.
   a. Stress the fact that every phenomenon is a result of cause and effect relationships.
   b. That ours is an orderly, but dynamically evolving universe.
3. The teacher can emphasize the constructive vs. the destructive uses of scientific knowledge.

*Committee report by Miss Nellie Bates, chairman; Mr. Wulliman, Tuscola, Illinois; Mr. Dollahan, Pekin, Illinois; Mr. Tilbury, Urbana, Illinois; Dr. Paton, University of Illinois.

VITAMIN STUDIES

(Continued from page 8)

Steamed yeast (use 15 pounds pressure)	10	10

Vitamin C, or cevitamic acid, is also water soluble, is destroyed by oxidation and heat, and is relatively unstable. In determining the effect of this vitamin both groups of rats should be fed the basal diet with the exception of the foods containing vitamin C (milk, citrus fruits, tomatoes, cabbage, etc.) The test group may be fed milk sterilized by boiling or by cooking under pressure and also cabbage cooked two to four hours in addition to the necessary salts and vitamin D source.

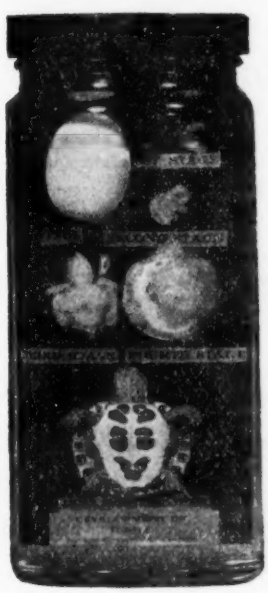
Vitamin D is a multiple sterol and may be either plant (phystosterol) or animal (cholesterol) origin. It is stable to heat and water and is fat soluble. The following diets are suggested as a means of learning the effect of vitamin D.

Vitamin D free diet	Group 1 Grams	Group 2 Grams
Ground yellow corn	76	76
Gluten flour	20	20
Calcium carbonate	3	3
Salt	1	1
Viosterol		5 drops

The young rates are maintained on this diet until they show distinct but not severe rickets (usually three weeks) Then they are killed and the tibias removed, scraped, immersed in 10 per cent formaldehyde for one day, then split lengthwise and immersed in 1 per cent silver nitrate solution. If there has been any calcium deposition, it may be easily observed because the zone of calcification will be stained dark by the silver nitrate. In the case of rickets there will be a tendency toward swelling or overgrowth of the cartilaginous tissue at the ends of the long bones together with an inability of the body to mobilize calcium and phosphorus.

*Biological supply companies keep rats in supply.

**When butterfat is removed from milk the vitamin A is also removed from milk. Buttermilk and skim milk contain most of vitamin B, C, and G originally present in the milk. Yeast is irradiated as a source of vitamin D.



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BOOK SHELF

HIGH SCHOOL BIOLOGY—Benedict, Knox and Stone. The Macmillan Company, Chicago, 1938.

This text is divided into eight units each of which is distinctly biological in nature. This emphasis on the biological aspect is notable throughout the entire book. The book might well be titled a human biology as there is perhaps more emphasis on the human side of biology than is found in most any other modern text. Chapters two and three are devoted to the kinds and distribution of man. The student will thus early feel that man is the real center of his interest in the subject. With sex education taking a larger place in the function of a biology course, any new biology text must stand the test of effectiveness of its section on reproduction. The text under consideration has two very complete and logically developed units on reproduction. Organic evolution is openly handled with a great mass of evidence presented in graphic form.

The contacts of biology with geology, chemistry, physics and other sciences are all carefully made with only the necessary parts of the other sciences being included. The text is modern in that it uses some of the newer ideas in classification.

The wealth of detail makes it a truly complete text. Many of the teaching aids are excellent. The illustrations are practically all new even to teachers of biology. The mechanics of the book are above criticism. Anyone contemplating a new text will do well to give this book a careful examination.

P. K. Houdek, Robinson, Illinois.

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Group IC

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S. A. McEVOY, Rockford High School, Rockford, Illinois
WILLIS T. MAAS, Dupo High School, Dupo, Illinois
JOHN C. CHIDDIX, Community High School, Normal, Illinois

Group 3

Testing Lubricating Oil
Hydrogenation of Vegetable Oils
Getting Sugar from Corn
Rayon—Synthetic Fibers
Photography

Group 4

Making Paint
Making Plastic Wood
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Making Lime
Making Polish—Wax type

Group 5

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Obtaining and Using Casein from Milk
Making Ink
Tanning Leather

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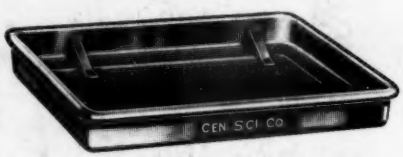

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